IR064-1

DOE–LM/GJ663–2004

Remedial Design/ Remedial Action Work Plan for the Monticello Mill Tailings Site Operable Unit III

August 2004

U.S. Department of Energy

Work Performed Under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management.
Approved for public release; distribution is unlimited.

DOE-LM/GJ663-2004

Remedial Design/Remedial Action Work Plan for the Monticello Mill Tailings Site, Operable Unit III

August 2004

Work Performed by S.M. Stoller Corporation under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado

Contents

Tables

Figures

End of current text

Acronyms

ARAR	applicable or relevant and appropriate requirement
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	contaminant of concern
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	feet
LM	Legacy Management
MCL	Maximum Contaminant Limit
MMTS	Monticello Mill Tailings Site
NEPA	National Environmental Policy Act
OU	operable unit
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design / Remedial Action
ROD	Record of Decision
RRM	residual radioactive material
U.A.C.	*Utah Administrative Code*
U.C.A.	*Utah Code Annotated*
U.S.C.	*United States Code*
UMTRCA	Uranium Mill Tailings Radiation Control Act
yd^3	cubic yards

End of current text

1.0 Introduction

1.1 Purpose

This Remedial Design/Remedial Action (RD/RA) Work Plan describes the installation of monitoring wells, the continuing enforcement of institutional controls at the MMTS OU III, and the future decommissioning of the permeable reactive barrier. It is prepared as a component of the selected remedy as outlined in the OU III ROD.

In June 2004, the U.S. Department of Energy, Office of Legacy Management (LM-50) issued the *Record of Decision (ROD) for the Monticello Mill Tailings Site Operable Unit III, Surface and Ground Water, Monticello, Utah* (DOE 2004a). The ROD presents the selected remedy for Operable Unit (OU) III—Surface Water and Ground Water, Monticello Mill Tailings Site (MMTS), located in Monticello, Utah (Figure 1). The selected remedy for ground water remediation is monitored natural attenuation, continuation of the existing institutional controls, and decommissioning of the permeable reactive barrier when it is no longer effective.

As discussed in the OU III ROD, post-ROD monitoring of the contaminated alluvial aquifer is required, and will provide the basis for evaluating the effectiveness of natural attenuation in achieving OU III remediation goals. The post-ROD monitoring effort will require the installation of three additional monitoring wells to the existing monitoring network. These wells will be installed in the alluvial aquifer downgradient of the permeable reactive barrier as shown in Figure 2. These monitoring wells will be installed in the summer of 2004, and water quality monitoring at these locations will occur twice yearly beginning in October 2004. The semi-annual sampling events will be conducted during the months of April and October.

Institutional controls have been put in place at the MMTS to ensure that the remedy is protective of human health and the environment. These controls include prohibiting installation of domestic wells in the contaminated aquifer, prohibiting construction of habitable structures in the floodplain along Montezuma Creek, and prohibiting removal of soil from areas in which contamination has been left in place. Section 2.2 of this document provides details of institutional controls.

The selected remedy of monitored natural attenuation does not rely on the continued effectiveness of the permeable reactive barrier. The permeable reactive barrier, which is anticipated to remain effective for a number of years, will be removed when it is no longer effective in removing contaminants from the contaminated aquifer. Removal of the permeable reactive barrier is discussed more fully in Section 1.3.3 of this document.

A Post-ROD Monitoring Plan will be developed and implemented and will provide the basis for measuring the progression of natural attenuation. Although it is not part of the RD/RA Work Plan, it is an essential part of the selected remedy.

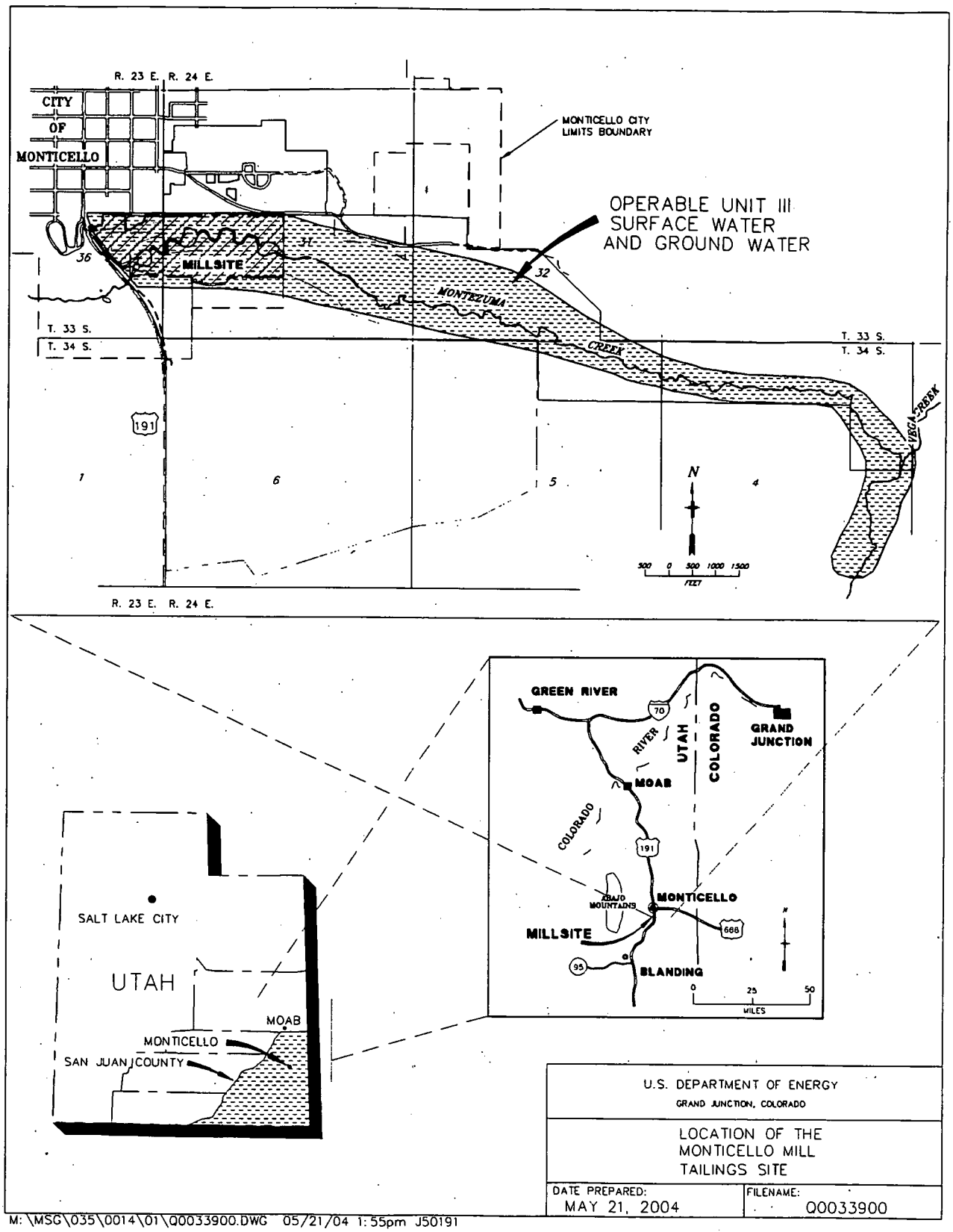

Figure 1. Monticello Mill Tailings Site, San Juan County, Utah

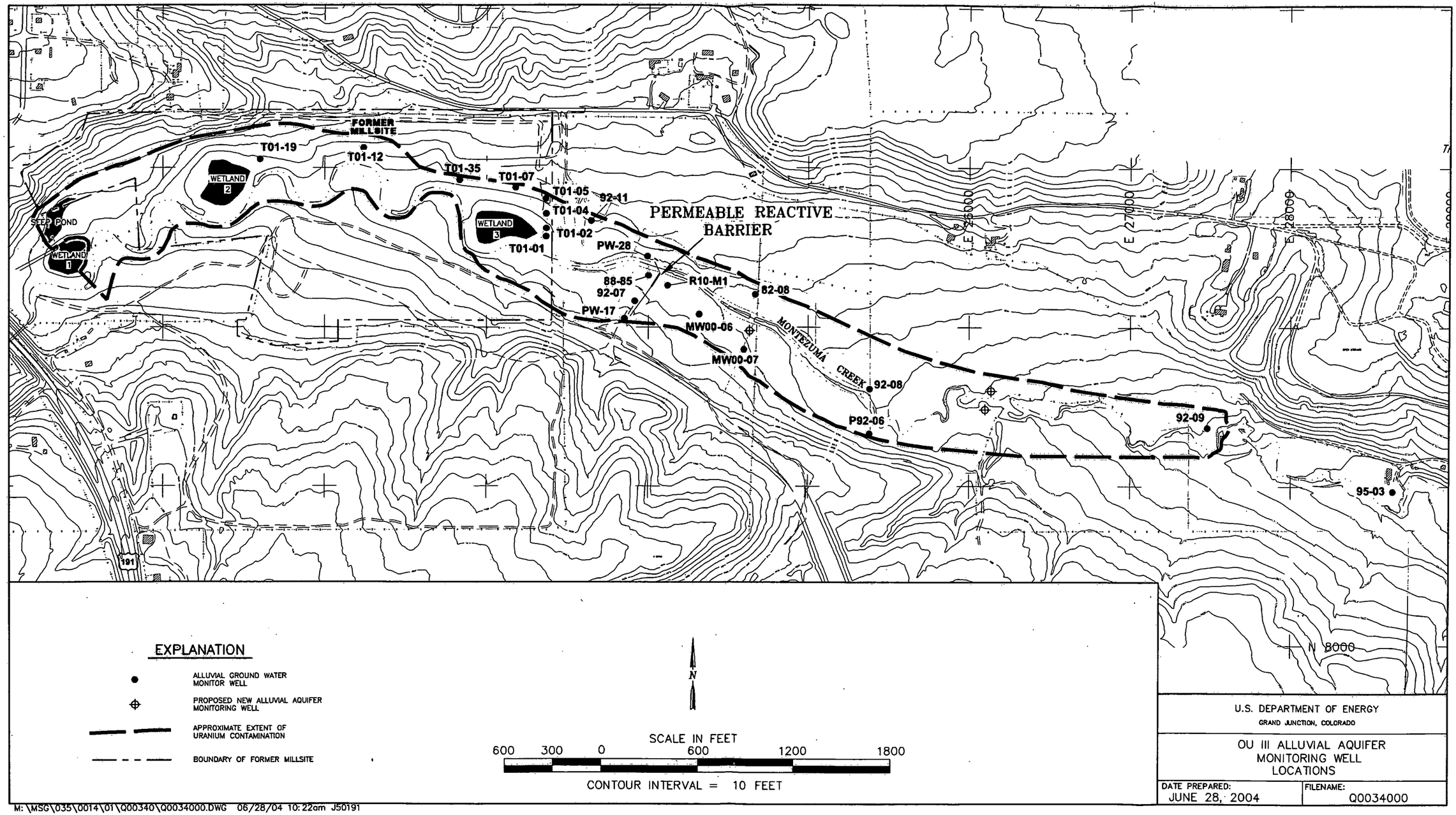

Figure 2. OU III Alluvial Aquifer Monitoring Well Locations

1.2 Selected Remedy Description—Monitored Natural Attenuation With Institutional Controls

The selected remedy, monitored natural attenuation with institutional controls, allows for natural geochemical and hydrologic processes to dissipate contaminants of concern (COC) in ground water to remediation goals within the established remediation time frame (42 years from October 2002). This remedy includes ground water and surface water monitoring (water quality analysis, water level monitoring, and stream flow monitoring) and continued enforcement of the existing institutional controls. Monitoring results will be used to verify and compare progress of monitored natural attenuation to predicted restoration rates, evaluate the continued effectiveness of the permeable reactive barrier, and assess potential impacts to ecological receptors. The permeable reactive barrier will be decommissioned when it no longer provides a benefit to remediation efforts.

Two of the three principal lines of evidence, contaminant source control and natural attenuation processes support the use of monitored natural attenuation at the site. In addition to the contaminant source control and natural attenuation processes, current and projected land use at the site and institutional controls which were put in place as part of the interim remedial action ROD also support the use of monitored natural attenuation at the site. The rationale are summarized as follows:

Contaminant source removal:

- Removal of the primary sources of ground water contamination on the millsite (approximately 2.5 million cubic yards (yd^3) of mill tailings, and contaminated soil and sediment.
- Removal from the millsite of 75,000 yd^3 of soil representing residual or secondary source material within the vadose zone beneath the former tailings piles from the millsite.
- Removal of soil and sediment hot-spot contamination along Montezuma Creek downstream (east) of the millsite. Intended primarily to mitigate risk associated with surface exposure, this action contributed to ground water contamination source control.
- Treatment of excavation water during millsite remediation removed an estimated 3 to 6 percent of the total preremediation inventory of uranium from the ground water system.
- Continued ground water treatment by a permeable reactive barrier, installed in 1999, and expected to operate effectively for an additional 5 to 10 years. The permeable reactive barrier immobilizes uranium and other COC's that flow through zero-valent iron, the reactive media. Approximately one-half to two-thirds of the flow of contaminated ground water in the alluvial aquifer is treated by the permeable reactive barrier.

Natural attenuation processes:

- A comprehensive conceptual model of ground water flow identifies natural hydrologic boundaries that control plume movement and attenuate COC concentrations. The downgradient extent of contamination has remained static since remedial investigation monitoring began in 1992.

- The primary contributor to potential human health risk (uranium) from ground water consumption can reasonably be expected to achieve its remediation goal in an acceptable time frame. Results of sorption batch tests justified the specific value of the uranium distribution coefficient used in the transport model.

In addition to the rationale discussed above, the potential for human exposure and risk has been mitigated by the implementation and enforcement of institutional controls and current and projected alluvial aquifer use.

- Effective institutional controls prohibit ingestion of contaminated ground water and minimize exposure to contamination that was left in place in the floodplain of Montezuma Creek so there is minimal risk to human health.

- The alluvial aquifer was not used for domestic purposes before the institutional controls were implemented, and future domestic use of the aquifer, if institutional controls were not in place, is not likely because of its low productivity.

- Alternate water supplies (municipal water or bedrock aquifer ground water) are readily available to the entire affected area.

1.3 Applicable or Relevant and Appropriate Regulatory Requirements

Federal and state applicable or relevant and appropriate regulatory requirements (ARARs) for OU III surface and ground water are listed in Tables 1 and 2. These tables present how the major ARARs apply to the remedy for OU III.

The selected remedy, monitored natural attenuation with institutional controls, complies with all ARARs and meets the state ground water standards within the accepted remediation timeframe (less than 42 years from October 2002).

The action specific ARARs are listed in Section 1.3.1 and were used to identify the specific design objectives for the remedy. Specifically, the state rules for water protection (for drinking water, ground water, and surface water) and Uranium Mill Tailings Radiation Control Act (UMTRCA) were used for deriving the performance expectations. Tables 3 and 4 give the numerical goals for each contaminant in ground water and surface water, respectively.

1.3.1 Compliance with ARARs

This section identifies and describes the means to achieve compliance with the remedy-specific ARARs for OU III. The following regulations, which are a subset of all potential federal and state ARARs for OU III, are ARARs for the selected remedy (DOE 2004a):

- Utah Safe Drinking Water Rules: relevant and appropriate chemical-specific requirement.

- Utah Groundwater Quality Protection: applicable chemical-, location-, and action-specific requirement.

- Utah Standards of Quality for Waters of the State: applicable chemical-, location-, and action-specific requirement.

- Utah Well Drilling Standards: applicable action- and location-specific requirement.

Table 1. Federal ARARs for OU III Surface and Ground Water

Standard, Requirement, Criterion, or Limitation	Citation	Description	Status	Comment
Safe Drinking Water Act National Primary and Secondary Drinking Water Standards	Title 42 *United States Code* Part 300(g) (42 U.S.C. 300[g]) 40 CFR Part 141 40 CFR Part 143	Establishes health-based standards for public water systems (maximum contaminant levels [MCLs]).	Relevant and appropriate through State of Utah standards as a chemical-specific requirement.	Because the quality of water in the alluvial aquifer could allow it to be used as a drinking water aquifer, the MCLs apply as cleanup standards.
Clean Water Act Water Quality Criteria	33 U.S.C. 1251–1376 40 CFR Part 131 "Quality Criteria for Water"	Criteria for states to set water quality standards on the basis of toxicity to aquatic organisms and human health.	Applicable through State of Utah standards as a chemical-, location-, and action-specific requirement.	Addresses Montezuma Creek contamination.
National Pollutant Discharge Elimination System	40 CFR Parts 122 through 125	Establishes standards for discharges of pollutants into waterways and through the use of underground injection wells.	Applicable through State of Utah standards as an action-specific requirement.	Potential storm-water discharges into Montezuma Creek must be controlled.
Dredge or Fill Requirements (Section 404)	40 CFR Parts 230 and 231 33 CFR Part 323 40 CFR Part 404	Regulates the discharge of dredged or fill material into navigable waters and manages wetland areas.	Applicable as location- and action-specific requirement.	Dredged or fill material requirements applicable through State of Utah standards. EPA has jurisdiction over wetlands at CERCLA sites in the state.
Clean Air Act National Primary and Secondary Ambient Air Quality Standards	42 U.S.C. 7401–7462 40 CFR Part 50	Establishes standards for ambient air quality to protect public health and welfare.	Applicable through State of Utah standards as a location- and action-specific requirement.	Fugitive dust could be generated through clearing of land or use of construction equipment.
Resource Conservation and Recovery Act	42 U.S.C. 6901 et seq. 40 CFR Parts 260–279	Regulates the generation, treatment, storage, and disposal of hazardous waste.	Applicable through State of Utah standards as a chemical- and action-specific requirement.	Hazardous waste is not known to exist within OU III. However, these regulations will apply if hazardous waste is generated during the decommissioning of the permeable reactive barrier.

Table 1. Federal ARARs for OU III Surface Water and Ground Water (continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Status	Comment
Uranium Mill Tailings Radiation Control Act (UMTRCA)	42 U.S.C. 2022, 42 U.S.C. 7901–7942	Establishes health-based ground water remediation standards for inactive uranium-ore processing sites.	Relevant and appropriate chemical- and action-specific requirement.	Although the cleanup standards apply only to certain specifically designated sites where uranium was processed, the ground water cleanup standards are relevant and appropriate to the OU III selected remedy.
Fish and Wildlife Coordination Act	16 U.S.C. 661–666 40 CFR 6.302(g)	Requires consultation when a federal department or agency proposes or authorizes any modification of any stream or other water body; requires adequate provisions for protection of fish and wildlife resources.	Relevant and appropriate as a location- and action-specific requirement.	The Montezuma Creek channel may be modified during OU III remedial activities (i.e., decommissioning of the permeable reactive barrier), which may result in temporary habitat loss for wildlife species.
Endangered Species Act	16 U.S.C. 1531–1543 50 CFR Parts 17 and 402 40 CFR 6.302(h)	Requires federal agencies to ensure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.	Applicable as a location- and action-specific requirement.	Although threatened and endangered species have not been identified in OU III, the MMTS is within the possible range of some of these species.
Floodplain/Wetlands Environmental Review	40 CFR Part 6, Appendix M	Establishes agency policy and guidance for carrying out the provisions of Executive Orders 11988, "Floodplain Management," and 11990, "Protection of Wetlands."	Applicable as a location- and action-specific requirement.	Remediation could affect site floodplains and wetlands.
National Environmental Policy Act (NEPA)	40 CFR 1500 10 CFR 1021	Requires that all federally undertaken actions be assessed for potential environmental impacts. All potential environmental impacts must be properly mitigated.	Relevant and appropriate as a location- and action-specific requirement.	NEPA values have been and will be incorporated in the CERCLA documentation.

Table 2. State ARARs for OU III Surface Water and Ground Water

Department/Division	Subject	Statute	Rule	Comments
Department of Environmental Quality, Division of Drinking Water	Safe Drinking Water Rules	Title 19, Chapter 4, Utah Code Annotated (U.C.A.)	R309, Utah Administrative Code (U.A.C.)	This is the state-implemented Safe Drinking Water Act program. The quality of the alluvial aquifer could allow it to be used as a drinking-water aquifer. Relevant and appropriate chemical-specific requirement.
Department of Environmental Quality, Division of Water Quality	Definitions and General Requirements	Title 19, Chapter 5, U.C.A.	R317-1, U.A.C.	Applicable chemical-, location-, and action-specific requirement.
	Standards for Quality for Waters of the State	Title 19, Chapter 5, U.C.A.	R317-2, U.A.C.	These rules are specific to Utah waters, though they are derived in part by using federal criteria. See particularly the nondegradation policy in R317-2-3. Applicable chemical-, location-, and action-specific requirement.
	Groundwater Quality Protection	Title 19, Chapter 5, U.C.A.	R317-6, U.A.C.	There is no corresponding federal program. Applicable chemical-, location-, and action-specific requirement.
	Utah Underground Injection Control	Title 19, Chapter 5, U.C.A.	R317-7, U.A.C.	Applicable chemical- and action-specific requirement if Class V injection wells are used in association with the selected ground water remedy.
	Utah Pollutant Discharge Elimination System	Title 19, Chapter 5, U.C.A.	R317-8, U.A.C.	Applicable location- and action-specific requirement for controlling storm-water runoff into Montezuma Creek associated with construction activities.
Department of Environmental Quality, Division of Air Quality	Utah Air Conservation Rules	Title 19, Chapter 2, U.C.A.	R307-101, R307-102, and R307-205, U.A.C.	This is the state-implemented National Ambient Air Quality Standards program. These rules are applicable through the State of Utah standards as a location- and action-specific requirement for controlling fugitive dust emissions from OU III.

Table 2. State ARARs for OU III Surface Water and Ground Water (continued)

Department/Division	Subject	Statute	Rule	Comments
Department of Environmental Quality, Division of Solid and Hazardous Waste	Hazardous Waste Management Rules (RCRA Subpart C)	Title 19, Chapter 6, Part 1, U.C.A.	R315, R315-1, R315-2, R315-5, R315-101, U.A.C.	The rules are applicable chemical- and action-specific requirements through the State of Utah standards; hazardous waste is not known to exist within OU III. However, these regulations will apply if hazardous waste is generated during the decommissioning of the permeable reactive barrier.
Department of Environmental Quality, Division of Radiation Control	Radioactive Material Management	Title 19, Chapter 3, U.C.A.	R313-12, R313-15-301, R313-19 through R313-22, and R313-25-18 through R313-25-22, U.A.C.	These provisions address the safe management, including disposal, of radioactive material. They also address standards for protection against radiation and licensing requirements. These state requirements are applicable chemical- and action-specific requirements.
Department of Environmental Quality, Division of Environmental Response and Remediation	Corrective Action Cleanup Standards Policy for CERCLA and Underground Storage Tank Sites	Title 19, Chapter 6, Part 1, U.C.A.	R311-211, U.A.C.	Remediation strategy must achieve compliance with this policy that sets forth criteria for establishing cleanup standards and requires source control or removal and prevention of further degradation. This policy is an applicable chemical-, location-, and action-specific state requirement.
Department of Natural Resources, Division of Water Rights	Well-drilling standards (standards for drilling and abandonment of wells)	73B3B25(2)(b), U.C.A.	R655B4, U.A.C.	Includes such requirements as performance standards for casing joints and requirements for abandoning a well. Also included are water rights issues associated with consumptive use. This law is applicable to all drilling anticipated for any of the alternatives and for any planned water use. Applicable action- and location-specific requirement.
	Dredge or fill requirements, including stream channel alteration.	73–3–29, U.C.A.		Applicable location- and action-specific requirement.

Table 3. Operable Unit III Ground Water Remediation Goals

Contaminant of Concern	Remediation Goal	Remediation Goal Reference or Basis
Arsenic	10 µg/L	Safe Drinking Water Act
Manganese	880 µg/L	Risk based
Molybdenum	100 µg/L	Uranium Mill Tailings Radiation Control Act
Nitrate (as nitrogen)	10 mg/L	Safe Drinking Water Act
Selenium	50 µg/L	Safe Drinking Water Act
Uranium	30 µg/L	Safe Drinking Water Act
Vanadium	330 µg/L	Risk based
Uranium-234/Uranium-238	30 pCi/L	Uranium Mill Tailings Radiation Control Act
Gross alpha	15 pCi/L	Safe Drinking Water Act

µg/L = micrograms per liter; mg/L = milligrams per liter; and pCi/L = picocuries per liter.

Table 4. Operable Unit III Surface Water Remediation Goals

Contaminant of Concern	Remediation Goal[a]
Arsenic	10 µg/L
Nitrate (as nitrogen)	4 mg/L
Selenium	5 µg/L
Gross alpha	15 pCi/L

[a]µg/L = micrograms per liter; mg/L = milligrams per liter; pCi/L = picocuries per liter.

- Utah Pollutant Discharge Elimination System: applicable location- and action-specific requirement.
- Utah Air Conservation Rules: applicable chemical-, location-, and action-specific requirement.
- Utah Radioactive Material Management: chemical- and action-specific requirement.
- Uranium Mill Tailings Radiation Control Act: relevant and appropriate chemical- and action-specific requirement.
- Dredge and fill requirements: applicable location- and action-specific requirement.
- Fish and Wildlife Coordination Act: relevant and appropriate as a location- and action-specific requirement.
- Floodplain/Wetlands Environmental Review: applicable location- and action-specific requirement.

Contaminant concentrations currently exceed ground water standards in Utah Safe Drinking Water Rules, Utah Groundwater Quality Protection, and UMTRCA. However, the regulatory provision for monitored natural attenuation allows that compliance with these standards is determined at a future date defined by the remediation time frame for the site. A condition of the Focused Feasibility Study (DOE 2004c) was that no remedial alternative was evaluated in the detailed analysis for which the expected remediation time frame exceeded 50 years. Ground water modeling results and observed trends show that concentrations of the COCs will be below

remediation cleanup levels (see Table 3) in 42 years from October 2002. During that time, institutional controls will prohibit the use of the contaminated ground water.

Construction of additional monitoring wells and well decommissioning, if required, will meet the substantive requirements of Utah Well Drilling Standards.

1.3.2 Institutional Controls

To ensure that the remedy remains protective of human health and the environment during the natural attenuation process, institutional controls have been applied at OU III. Land use restrictions have been implemented within the floodplain on Montezuma Creek where contaminated sediments were left in place. Prohibitions have also been emplaced on the use of contaminated alluvial ground water. Section 2.2 describes the institutional controls in greater detail.

1.3.3 Decommissioning of the Permeable Reactive Barrier

The Monticello permeable reactive barrier, installed in summer 1999, is effective in treating contaminated ground water at the site and is expected to provide continued benefit for an additional 5 to 10 years (to year 2014). The permeable reactive barrier treats approximately two-thirds of the contaminated ground water flux at its location. Contaminants of concern that are being effectively removed from the ground water include arsenic, molybdenum, nitrate, selenium, uranium, and vanadium. Treatment by the permeable reactive barrier is not required to meet the remediation goals in the acceptable time frame (less than 42 years from October 2002). However, it will continue to treat ground water and remain in place for further studies until it becomes ineffective or causes unacceptable changes in the hydrogeology (e.g., excessive ground water mounding).

When the permeable reactive barrier is decommissioned, (1) temporary stream channel modifications may be needed to excavate the permeable reactive barrier, causing temporary habitat loss for wildlife species; (2) storm-water runoff may occur during construction activities (3) air emissions may occur during excavations; and (4) radioactive material may be generated, requiring transportation and disposal. Engineering controls will be used to capture and minimize the discharge of sediment to Montezuma Creek during construction activities to ensure meeting Utah Pollution Discharge Elimination System requirements. Engineering measures will also be used to mitigate air emissions during construction activities to ensure Utah Air Conservation Rules are met. Handling and disposal of radioactive contamination will conform to requirements of Utah Radioactive Material Management. If stream channel modifications are required, Stream Channel Alteration Permit requirements will be evaluated to ensure compliance with dredge-and-fill requirements. The U.S. Fish and Wildlife Service will be consulted to ensure that adequate provisions exist for the protection of wildlife resources. All wetland-area disturbances will follow the Monticello Wetlands Master Plan (DOE 1996) that was developed to adhere to Floodplain/Wetlands Environmental Review requirements.

1.3.4 Post-Record of Decision Monitoring Plan

Post-ROD monitoring of ground water and surface water will provide the basis for evaluating the performance of natural attenuation in achieving OU III remediation goals and thus complying

with ARARs. The Post-ROD Monitoring Plan, described in Section 2.4, includes ground water monitoring, surface water monitoring, and biomonitoring.

Biomonitoring is required to determine compliance with ARARs because of the potential for bioaccumulation of selenium by ecological receptors. Selenium concentrations currently exceed state Standards of Quality for Water, but it is assumed that concentrations will decrease as the chemistry of surface water and ground water stabilizes following millsite remediation. If selenium concentrations do not decrease as expected, compliance with that standard will be reevaluated.

2.0 Remedial Design/Remedial Action Work Plan Elements

This RD/RA Work Plan addresses the components that remain to be completed to implement the selected remedy. Completion of the monitoring network is required to implement monitored natural attenuation.

2.1 Well Installation

Three new wells are required to complete the monitoring network. These wells are scheduled to be installed by August 31, 2004.

2.1.1 Well Construction Specifications and Installation Procedures

The three new wells will be installed using direct-push coring technology. This method has proven successful by the installation of about 100 alluvial wells at the site using a Geoprobe rig. At the selected locations indicated in Figure 2, continuous soil samples will be collected using a Geoprobe and a 2-inch diameter core barrel until core-barrel refusal in the bedrock. The depth to bedrock at the respective well locations is expected to be less than 20 feet (ft). The saturated thickness of the alluvium is expected to be about 5 ft. All pertinent corehole information will be recorded in the field on a standard drilling/well log form (Figure 3).

Following the coring procedure, a 1-inch well will be installed in the corehole. This will be done either by driving a 3.25-inch diameter drive rod with expendable tip to the target depth in the original corehole to serve as a temporary casing for well installation, or by installing the well directly in the open corehole. Wells will be constructed of 1-inch flush threaded schedule 40 PVC casing, machine-slotted screen (#10 slot), and end caps. Screen length will be 5 ft. The base of the screen will be set on the bedrock surface. After setting the well screen and casing, the primary filter pack will be placed from the total depth to 1-ft above the top of the screen slots with silica sand (most likely #20-40 silica sand). A 1-ft layer of fine silica sand (#100) will be placed above the coarse sand pack. The annular space will then be filled to 2-ft below ground surface using bentonite chips or pellets. Potable water will be used to hydrate the chips or pellets at the time of placement. No more than 2 ft of pellets or chips will be placed before they are hydrated. The remainder of the hole will be filled with concrete, which will extend to form a 2-ft × 2-ft × 4-inch thick pad approximately 2 inches above ground surface. The top of the well will be housed in a 4 or 6-inch diameter, flush mount steel vault with bolt-down lid, embedded in the concrete pad. A schematic view of the proposed new wells is shown in Figure 4.

S.M. Stoller Corp.
2597 B ¾ Road
Grand Junction, Colorado 81503

Borehole Summary

Page _____ of _____

Facility _____ Site _____
Rig Type _____ Bit/Auger Size _____

Drilling Company _____ Drill Operator _____

Well Number _____
Ground Elev. _____
Hole Depth (ft) _____
Well Depth (ft) _____
Stick-Up Height (ft). _____
Slot Size _____
No. of Completions _____

	Type/Size	Vol. (ft^3/gal)	Interval (ft)
Surface Casing			to
Blank Well Casing			to
Well Screen			to
Sump/End Cap			to
Grout			to
Bentonite Seal			to
Upper Sand Pack			to
Lower Sand Pack			to

Location Sketch

Locking Cover Installed Y/N Padlock No. _____
Drilling Method _____ Sampling Method _____
Date Drilled _____ Date Developed _____ Fluid Level/Date _____
Geologist/Sampler(s) _____ Remarks _____

Depth[a] (ft)	Blows Per 6"	PID ppm	Sample No.: Interval	Well Construction	Graphic Log	Description: Required information: Typical name; Unified Soil Classification; Munsell soil color; Rock Color Chart; percentage sand and gravel; sorting (poor to well); grain angularity; induration or plasticity; moisture content (moist to saturated)
0						

[a] all depths measured from ground level

Completed By _____ Verified By _____

Figure 3. Standard Borehole/Well Logging Form

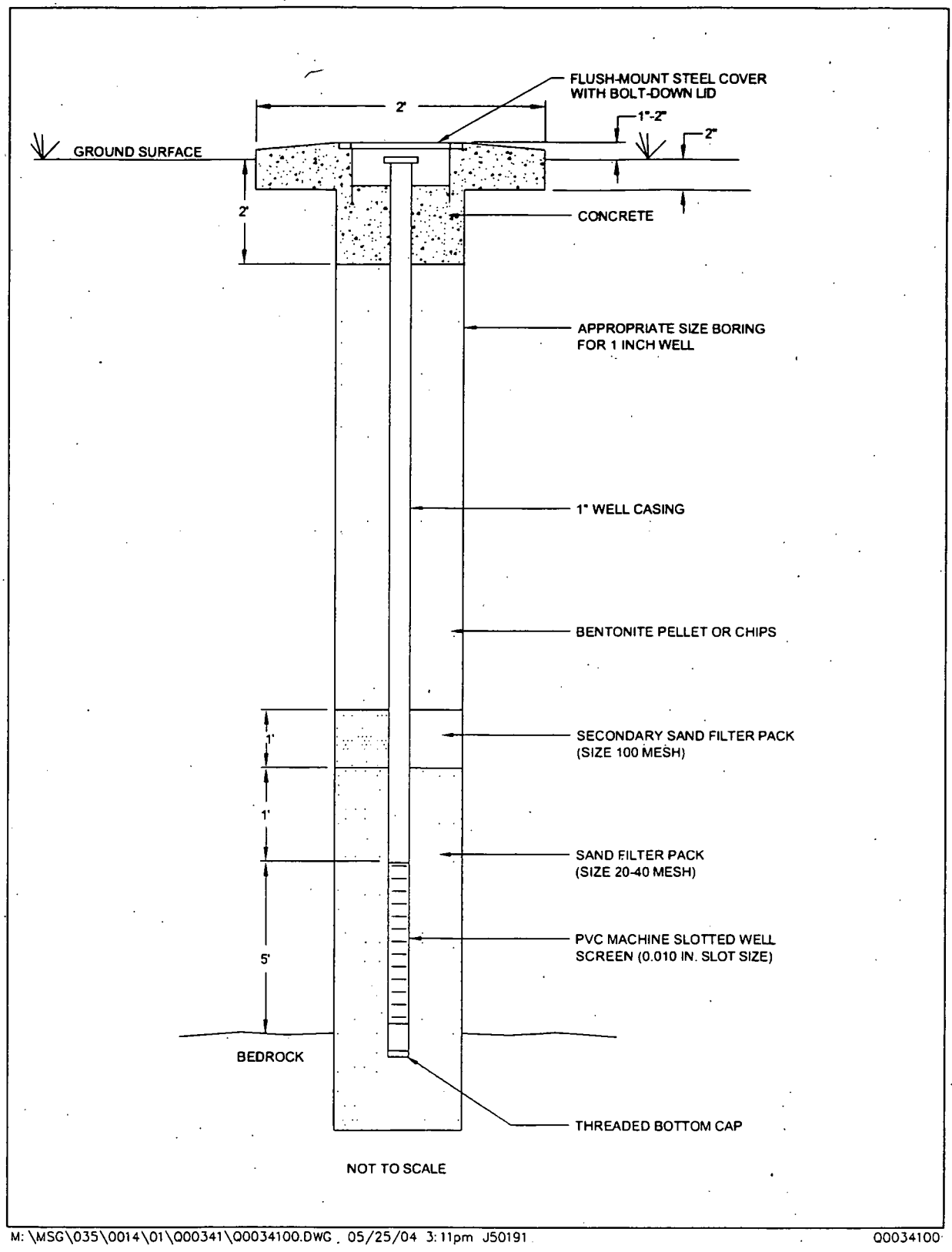

Figure 4. Schematic of Proposed New Well Construction

After installation, each new well will be developed by performing multiple cycles of surging and pumping to remove fine sediment from the screen interval. Development will proceed until water quality parameters (pH, temperature, electrical conductivity) are stable and the water evacuated from the well is relatively free of sediment (e.g., < 5 nephelometric turbidity units). If the turbidity goal is unobtainable and all other parameters are stable, a field decision will be made concerning continued well development. Water evacuated from the well during development will be discarded on the ground. Field measurements and volume of water evacuated will be recorded in a project logbook for water sample collection. The location and elevation of each new will be measured using land survey methods. The accuracy of the horizontal coordinates, referenced to the local Monticello Projects Coordinate System and State Plane Coordinate System, shall be ± 0.5 ft. The accuracy of the vertical elevation, referenced to established survey control monuments based on the National Geodetic Survey datum, shall be within ± 0.05 ft.

2.1.2 Investigation Derived Waste Management

Hazardous wastes as defined by the Resource Conservation and Recovery Act are not anticipated to be generated or produced as a result of the work activities described in this RD/RA Work Plan. It is possible that sediments contaminated with residual radioactive materials (RRM) may be encountered during the well installation procedure. All sediments removed from the 2-inch diameter core barrel will be immediately surveyed for RRM contamination by an on-site Radiological Control Technician. Any sediments found to be contaminated will be containerized and taken to the Temporary Storage Facility pending final disposal at a later date at the Grand Junction Disposal Site in Grand Junction, Colorado. Sediments not contaminated may be scattered on the ground surface near the well location.

Well development water will be discharged on the ground surface. Precautions will be taken to ensure that the well development water is not discharged into Montezuma Creek.

2.1.3 Permits and Access

Each of the three monitoring wells are less than 30 feet in total depth and will be used for monitoring purposes only. Therefore, according to well installation regulations (Utah Administrative Code, Section R655) promulgated by State of Utah, Department of Natural Resources, Division of Water Rights, neither well installation permits, nor water right appropriations are required for the three new monitoring wells to be installed per this RD/RA Work Plan.

All three monitoring wells are located on privately-owned property. Access agreements for entering these properties and installing the wells are currently being negotiated with the respective property owners. All access agreements will be secured by July 30, 2004.

2.2 Institutional Controls

Institutional controls have been implemented at OU III to prohibit use of contaminated alluvial ground water and to restrict land use within the floodplain of Montezuma Creek where contaminated sediments were left in place and supplemental standards were applied. The former millsite which was transferred to the City of Monticello through the National Park Service also limits the use of the property in perpetuity as a public park. The quitclaim deed transferring

ownership of the millsite to the City of Monticello also prohibits construction of habitable structures, camping, and removal of soils from areas where supplemental standards were applied.

The Utah State Engineers' office issued the *Ground Water Management Policy for the Monticello Mill Tailings Site and Adjacent Areas,* which became effective May 21, 1999. The policy states that new applications to appropriate water for domestic use from the shallow alluvial aquifer within the boundaries of the Monticello Ground Water Restricted Area will not be approved; existing water rights are not affected. The policy states that applications to drill wells into the deeper Burro Canyon Formation would be approved if it could be demonstrated that the well construction would not allow the shallow alluvial water to flow to the deeper formation.

Because radioactively contaminated soil and sediment exceeding radium-226 standards in Title 40 CFR Part 192.12 remained in the Montezuma Creek floodplain following hot-spot remediation, restrictive easements were placed on private properties to which supplemental standards were applied. The restrictive easements generally apply to the floodplain of Montezuma Creek and extend about 50 ft from the centerline of the creek. The restrictive easement prohibits the building of habitable structures on and the removal of soils from within the easement area. Property owners were compensated for restrictive easements on their properties.

As part of the CERCLA process, DOE will continue to monitor the sites, with oversight provided by EPA and UDEQ, to ensure the following:

- Compliance with ARARs,
- Remedial actions taken remain protective of human health and the environment,
- Institutional Controls continue to be in force and enforcement actions are taken if necessary, and
- Adequate information is collected for preparation of the CERCLA Five-Year Review report.

DOE has implemented this monitoring program through the *Monticello Long-Term Surveillance and Maintenance Administrative Manual* (DOE 2002), which describes long-term surveillance and maintenance activities that are conducted at the Monticello CERCLA sites. The document references operating procedures that define the work conducted by permanent employees located in Monticello, Utah. The work includes monitoring compliance with institutional controls (i.e., prohibitions on installation of wells into contaminated water, prohibitions on removal of contaminated soils, prohibitions on construction of habitable buildings in areas in which supplemental standards have been applied), monitoring the condition of the repository and associated facilities (i.e., evaporation pond, leachate collection and removal systems, leak detection systems, and temporary storage facility for contaminated materials), and monitoring contaminated soils left in place at areas in which supplemental standards have been applied. The operating procedures also identify how annual inspections and CERCLA 5-year reviews will be conducted.

2.3 Decommissioning of the Permeable Reactive Barrier

The permeable reactive barrier will be monitored to ensure that no adverse impact to ground water quality or land use occurs. Permeable reactive barrier failure is indicated by loss of treatment effectiveness whereby COC concentrations in the reactive media equal or exceed concentrations in the influent ground water, or when ground water mounding reaches the top of the permeable reactive media.

Concentration trend analysis will consider possible effects associated with the eventual decommissioning of the permeable reactive barrier. Such effects will depend on contaminant concentrations in ground water hydraulically upgradient of the permeable reactive barrier and whether the disturbance to the subsurface mobilizes contaminants to ground water or flow directions change following the removal of the permeable reactive barrier and replacement with clean fill.

When the Monticello permeable reactive barrier ceases to provide continued benefit to the OU III project (in approximately 2014), it will be removed. As discussed in Section 1.3.3, removal and disposal of the permeable reactive barrier will be in compliance with ARARs.

2.4 Post-Record of Decision Monitoring Plan

The *Monticello Mill Tailings Site, Operable Unit III—Post-ROD Monitoring Plan* (DOE 2004b) is currently in development. Although it is not part of the RD/RA Work Plan, it is an essential part of the selected remedy and is therefore discussed in this document.

Post-ROD monitoring consists of water quality monitoring, hydrologic monitoring, and biomonitoring. The *Monticello Mill Tailings Site, Operable Unit III—Post-ROD Monitoring Plan* (DOE 2004b) provides additional detail regarding monitoring locations, frequency, and rationale, as well as field and laboratory methods, and sample chain of custody protocols. The *Record of Decision for the Monticello Mill Tailings Site Operable Unit III, Surface Water and Ground Water* (DOE 2004a) describes the evaluation of monitoring data that will be undertaken to ensure that the monitored natural attenuation is working effectively and that the remediation goals will be attained.

Water quality monitoring will be conducted in the shallow alluvial aquifer, in surface water including a number of seeps on the former millsite, in the Burro Canyon Formation bedrock aquifer, and within the permeable reactive barrier. Water quality monitoring will be conducted in two separate events to occur each year during April and October, coincident with annual periods of high and low flow. Monitoring during these months will record the full range of analyte concentrations attributable to seasonal effects. Analyte concentrations are typically greatest during low-flow conditions (fall) and lowest during high-flow (spring).

In addition to the regular surface water monitoring for evaluating the progress of monitored natural attenuation identified in the *Record of Decision for the Monticello Mill Tailings (USDOE) Site Operable Unit III, Surface and Ground Water, Monticello, Utah* (DOE 2004a), additional monitoring will be conducted to assess the potential for adverse ecological effects from selenium, as necessitated by recent concentration increases. Biomonitoring of OU III will be conducted primarily to determine if selenium is accumulating to levels that are considered

wetland areas created on the former millsite and are likely to be most sensitive to selenium concentration increases. An updated wildlife survey will be completed to identify wildlife species using the area (including species identified as threatened and endangered and state sensitive) and determine appropriate sample locations and media. The monitoring is designed to address concerns regarding exposure to surface water and sediment and the potential for bioaccumulation through the food chain.

3.0 Schedule and Funding

Installation and development of the three monitoring wells will be completed by August 31, 2004. Monitoring activities will commence during the month of October 2004. Scheduled tasks are identified in Table 5.

Table 5. Schedule

Task	Date
Draft-Final RD/RA Work Plan submitted to EPA/UDEQ	August 20, 2004
Draft-Final Post ROD Monitoring Plan submitted to EPA/UDEQ	August 27, 2004
Well Installation and Development Complete	August 31, 2004
EPA and UDEQ Accept Post-Rod Monitoring Plan	September 1, 2004
Annual Inspection[1]	September 15, 2004
Post-ROD Monitoring begins	October 2004
Surface and Ground Water Sampling[2]	
Obtain Surface and Ground Water Samples	October 2004
Obtain Surface and Ground Water Samples	April 2005
Sediment and Surface Water Sampling[3]	
Program Directive for Sediment and Surface Water Samples	September 15, 2004
Obtain Sediment and Surface Water Samples	October 2004
Obtain Sediment and Surface Water Samples	April 2005
Macroinvertebrate Sampling[4]	
BTAG Field Meeting to establish probable locations for placement of macroinvertebrate sampling devices	October 5, 2004
Program Directive for macroinvertebrate sampling	February 1, 2005
Place macroinvertebrate samplers (timing dependent upon BTAG recommendations)	Spring, 2005
Collect macroinvertebrate samples (timing dependent upon BTAG recommendations)	Summer, 2005
Wildlife Survey	
Program Directive for Wildlife Survey	January 15, 2005
Obtain Subcontractor for Wildlife Survey	February 15, 2005
Complete Wildlife Survey (timing dependent upon program directive)	Summer, 2005
Complete Wildlife Survey Report	November 1, 2005
CERCLA 5-year review[5]	June 2007
Decommission Permeable Reactive Barrier	2014

[1]Annual inspections are scheduled for September of each year in perpetuity.
[2]Sampling scheduled for April and October of each year until remediation goals are met.
[3]Sampling will be conducted in April and October through October 2006. Sampling beyond 2006 will be conducted if trigger levels identified in the *Post-Rod Monitoring Plan* (DOE 2004a) are exceeded.
[4]Sampling beyond 2005 will be conducted if trigger levels identified in the *Post-Rod Monitoring Plan* (DOE 2004a) are exceeded.
[5]CERCLA 5-year reviews are scheduled in June every five years in perpetuity.

DOE's budget for Fiscal Year (FY) 2004 for the Monticello project is $1,084,712. The FY 2005 budget has not been negotiated but it is based on DOE's Life-cycle Baseline Estimate. The Life-cycle Estimate includes indirect costs, escalation, and contingency. The 2004 Life-cycle Baseline for the Monticello project for FY2005 through FY2009 is as follows:

FY2005	$1,095,349
FY2006	$ 995,266
FY2007	$1,052,993
FY2008	$1,047,692
FY2009	$1,074,932

Decommissioning of the Permeable Reactive Barrier will be scheduled in the Life-cycle Baseline for year 2014 at a cost of $100,000 to $600,000. The actual cost will be dependent upon whether hazardous waste is encountered. The actual date of decommissioning will be dependent on performance of the permeable reactive barrier.

4.0 Quality Assurance

All work identified in this RD/RA Work Plan will be conducted in accordance with the requirements of the *Quality Assurance Manual* (DOE 2004d). This manual implements the specific requirements and philosophy of DOE Order 414.1A, *Quality Assurance*. The specific requirements of DOE Order 414.1A are identified in this manual which also includes the requirements of 10 CFR 830 Subpart A, *Quality Assurance Requirements*, ANSI/ASQC E4–1994, *Quality Assurance Program Requirements for Environmental Data Collection and Environmental Technology Programs*, ISO 9001–2000, *Quality Management Systems – Requirements*, and ISO 14001-96, *Environmental Management Systems*. All these standards are similar in content. Additionally, work will be performed in accordance with the *Health and Safety Manual* (DOE 2004e).

5.0 References

Rule R317-2. "Standards of Quality for Waters of the State," *Utah Administrative Code*, March 3, 2003.

Rule R317-6. "Ground Water Quality Protection," *Utah Administrative Code*, March 3, 2003.

Rule R655, "Natural Resources, Water Rights," *Utah Administrative Code*, March 1, 2004.

U.S. Department of Energy (DOE), 1996. *Wetlands Master Plan*, (P-GJPO-926), and all annual updates, prepared by Rust Geotech for the U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, March.

———, 1998. *Monticello Mill Tailings Site, Operable Unity III—Feasibility Study of Surface Water and Groundwater*, GJO-97-21-TAR, prepared for the U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado.

U.S. Department of Energy (DOE), 2002. *Monticello Long-Term Surveillance and Maintenance Administrative Manual*, GJO–2001–224–TAR, prepared for the U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, April.

———, 2004a. *Record of Decision for the Monticello Mill Tailings Site (USDOE) Operable Unit III, Surface Water and Ground Water, Monticello, Utah,* DOE-LM/GJ629-2004, prepared for the U.S. Department of Energy, Grand Junction, Colorado.

———, 2004b. *Monticello Mill Tailings Site, Operable Unit III—Post-ROD Monitoring Plan*, prepared for the U.S. Department of Energy, Grand Junction, Colorado (in preparation).

———, 2004c. *Monticello Mill Tailings Site, Operable Unit III—Remedial Investigation Addendum/Focused Feasibility Study,* GJO-2003-413-TAC, prepared for the U.S. Department of Energy, Grand Junction, Colorado.

———, 2004d. *Quality Assurance Manual*, STO 1, Grand Junction, Colorado.

———, 2004e. *Health and Safety Manual*, STO 2, Grand Junction, Colorado.

End of current text